Floor Systems

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FLOOR SYSTEMS
PREREQUISTE

PRE-EXPERIENCE NECESSARY:

1. SAFETY: RELATED TO TOOLS, EQUIPMENT, AND THE JOB SITE.

2. MEASURING: THE STUDENT MUST BE ABLE TO MEASURE ACCURATELY TO THE $1/16^{th}$ of an inch.

3. LEVELING: THE STUDENT MUST BE ABLE TO READ A LEVEL AND UNDERSTAND HOW IMPORTANT IT IS TO MAINTAIN TIGHT TOLLERANCES.

4. ESTIMATING: THE STUDENT MUST BE ABLE TO PERFORM BASIC MATH COMPUTAT IONS TO ACCURATEL Y ESTIMATE THE AMOUNT OF MATERIALS AND THE TIME NECESSARY TO COMPLETE THE TASK.

5. TOOL USE AND SAFETY: THE STUDENT MUST BE PROPERLY TRAINED TO USE HAND TOOLS, PORTABLE POWER TOOLS AND STATIONARY POWER TOOLS.

6. FASTENERS: THE STUDENT MUST BE EXPOSED TO THE VIRIOUS TYPES OF FASTENING DEVICES, FROM NAILS TO HANGERS.

7. BUILDING MATERIALS: THE STUDENT MUST BE EXPOSED TO THE VARIOUS TYPES OF BUILDING PRODUCTS, FROM DIMENSIONAL LUMBER TO LAMINATES.

8. LAYOUTS: THE STUDENT MUST HAVE EXPERIENCED THE APPLICATION OF LAYING OUT STOCK @ 16” O/C & 24”O/C.

9. COMPONETS OF THE RESIDENTIAL STRUCTURE: THE STUDENT SHOULD BE VERSED IN THE TERMS AND PARTS OF THE BUILDING.

10. PRINT READING: THE STUDENTS MUST BE ABLE TO READ AND IDENTIFY A BASIC BLUE PRINT.

FLOOR SYSTEMS
(SPECIAL APPLICATIONS)
LAYER 2

1. STUDENTS APPLY THE FLOOR SYSTEM TO DECKS.

2. STUDENTS APPLY THE FLOOR SYSTEM TO A SECOND FLOOR.

3. STUDENTS INSTALL JOISTS FOR A CANTILEVER FLOOR.

4. STUDENTS TNST ALL VARIOUS TYPES OF JOISTS.

5. STUDENTS INSTALL VARIOUS TYPES OF BRIDGING.

6. STUDENTS INSTALL JOISTS FOR SPECIAL APPLICATIONS. BATH TUBS, PLUMBING, PARTITIONS, ETC.

FLOOR SYSTEMS
THE LAYERED APPROACH

(The implementation of the above knowledge)

APPLICATION:

1. STUDENTS READ A PRINT TO DEVELOPE A MATERIALS LIST.

2. STUDENTS ASSEMBLE SILLS ON THE FOUNDATION. THEY CHECK THE FOUNDATION FOR SQUARE, BORE PREASURE TREATED Sills TO RECEIVE ANCHOR BOLTS, INSTALL SILL SEAL, BUG SHEILD, AND SHIM SILLS AND USE A STRING LINE TO ENSURE LEVEL AND STRTGHT.

3. STUDENTS SORT STOCK TO BE CROWNEDAND CUT AS NEEDED.

4. STUDENTS LAYOUT HEAD JOISTS AND MARK BEAM (16” O/C).

5. STUDENTS ASSEMBLE JOIST AT ALL LAYOUT MARKS.

6. STUDENTS INSTALL DECKING MATERTALS (PLYWOOD) USING GLUE AND NAILS UP TO BRIDGING POINT.

7. STUDENTS INSTALL BRIDGING.

8. STUDENTS COMPLETE COVERING THE DECK WITH PLYWOOD

9. STUDENTS COMPLETE ALL CUT OFFS AND CUT OUTS.

Introduction

The purpose of this learning experience is to familiarize the students with the various floor framing members and how they are tied together, creating a solid base for the rest of the building in a residential structure.

Purpose: To teach students in the carpentry program floor systems. The student must master the base to the residential structure before they can precede any further.

Core Objective: After completing this unit the student will be able to identify the various parts of the floor system, choose the proper materials for the span, layout and cut the stock and finally assemb1e an 10'x12' floor system.

Objectives: After completing this lesson, the student will be able to:

a. Identify floor and sill parts on a work sheet.
b. Identify various fasteners needed for assembly.
c. Identify the correct size of material for the span.
d. Define the various parts and what function they serve.
e. Estimate time and materials needed.
f. Build a floor system.
g. Identify different types of joist.
h. Identify different types of beams.
i. Apply building codes to the floor system.

Estimated Time: Approximately 20 contact hours.

Standards

Industry Standards: State building codes found in the CABO one and two family dwelling codebook for the state of Rhode Island; (A copy of Ch 5 of CABO is enclosed)

Ch3 301.3 Dead load
301.4 Live load
Ch5 502.1 General
502.1.1 Preservation-treated lumber
502.1.2 Blocking the sub-flooring
502.3 Allowable spans
502.3.3 Allowable joist spans
502.3.2 Joist under bearing partitions
502.3.3 Allowable girder spans
502.4 Bearing
502.4.1 Floor systems
502.4.2 Joist framing
502.5 Lateral restraint at supports
502.5.1 Bridging
502.6 Drilling and notching
502.7 Holes
502.8 Fastening

New Standards Performance Standards:

English Language Arts

E1c. The student reads and comprehends informational material to develop understanding and expertise and produces written or oral work that:

* **Restates or summarizes information;**
* **Relates new information to prior knowledge and experience;**
* **Extend ideas;**
* **Makes connections to related topics or information.**

E3a. The student participates in one-to-one conferences with a teacher, paraprofessional, or adult volunteer in which the student:

* Initiates new topics in addition to responding to adult-initiated topics:
* **Ask relevant questions;**
* **Responds to questions with appropriate elaboration;**

* Uses language cues to indicate different levels of certainty or Hypothesizing, e.g., "what if." "very likely...," "I'm unsure whether..."
* **Confirms understanding by paraphrasing the adult's directions or Suggestions**.

E3e. The student listens to and analyzes a public speaking performance; that is, the student:

* **Takes notes on salient features.**
* **Identifies types of arguments (e.g., causation, authority, analogy) and Identifies types of logical fallacies (e.g., ad hominem, inferring causation from correlation, over-generalization);**
* **Formulates a judgment about the issues under discussion.**

Mathematics

M1. Number and operation concepts

The student produces evidence that demonstrates understanding of number and operation concepts; that is, the student:

M1a. Uses addition, subtraction, multiplication, division, and exponentiation in forming and working with numerical or algebraic expressions (the statement has been modified).

M6. Mathematical Skills and Tools

The student demonstrates fluency with basic and important skills by using these skills accurately and automatically, and demonstrates practical competence and persistence with other ski11s by using them effective1y to accomplish a task, perhaps referring to notes, or books, perhaps working to reconstruct a method; that is, the student:

M6a. Carries out numerical calculations and symbol manipulations effectively, using mental computations, pencil and paper, or other technological aids" as appropriate.

M6b. Uses a variety of methods to estimate the values" in appropriate units, of quantities met applications, and rounds numbers used in applications to an appropriate degree of accuracy.

M61. Uses tools such as rulers, tapes, compasses, and protractors in solving problems.

M6m. Knows standard methods to solve basic problems and uses these methods in approaching more complex problems.

M7 Mathematical Communication

The student uses the language of mathematics, its symbols, notation, graphs, and expressions, to communicate through reading, writing, speaking, and listening, and communicates about mathematics by describing mathematical ideas and concepts and explaining reasoning and results; that is, the student:

M7b. Uses mathematical representations with appropriate accuracy, including numerical tables, formulas, functions, equations, charts, graphs, and diagrams.

Applied Learning

Al Problem Solving

Design a product, service, or system

A1a. The student designs and creates a product, service, or system to meet an identified need~ that is, the student:

* **Develops a design proposal (the statement has been shortened);**
* **Plans and implements the steps needed to create the product, service, or system;**
* **Makes adjustments as needed to conform with specified standards or regulations**
* **Evaluates the product, service, or system in terms of the criteria established in the design proposal (the statement has been modified).**

Plan and organize an event or an activity

Alc. The student plans and organizes an event or an activity:

* **Develops a planning schedule (the statement has been modified).**
* **Implements and adjusts the planning schedule (the statement has been modified);**
* **Evaluates the success of the event or activity using qualitative and/or quantitative methods;**
* **Makes recommendations for planning and organizing subsequent similar event or activities.**

A4. Learning and Self-Management Tools and Techniques

A4a. The student learns from models; that is, the student:

* Consults with and observes other students and adults at work and analyzes their roles to determine the critical demands, such as
  demands for knowledge and skills, judgment and decision making;

* Identifies models for the results of project work, such as
  uses what he or she learns from models in planning and conducting
  project activities.

A4b. The student reviews his or her own progress in completing work activities and adjusts priorities as needed to meet deadlines; that is, the student:

* Develops and maintains work schedules that reflect consideration of priorities;
* Manages time;
* Monitors progress towards meeting deadlines and adjusts. priorities as necessary

The student evaluates his or her performance; that is, the student:

* Establishes expectations for his or her own achievement;
* Critiques his or her wok in light of the established expectations;
* Seeks and responds to advice and criticism from others.

A5. Tools and Techniques for Working With Others

A5a. The student participates in the establishment and operation of self-directed work teams; that is, the student:

* Defines roles and shares responsibilities among team members:
* Sets objectives and time frames for the work to be completed;
* Establishes processes for group decision-making;
* Reviews progress and make adjustments as required

A5b. The student plans and carries out a strategy for including at least one new member in a work program; that is, the student:

* Plans and conducts an initial activity to introduce the new member to the work program;
* Devises ways of providing continuing on-the-job support and advice;
* Monitors the new member's progress in joining the program, and revises the kinds and ways of providing support and advice accordingly;
* Reviews the success of the overall strategy.

A5c. The student completes a task in response to a commission from a client; that is, the student:

* Negotiates with the client to arrive at a plan for meeting the client's needs that is acceptable to the client, achievable within available resources, and includes agreed-upon criteria for successful completion;
* Monitors client satisfaction with the work in progress and makes adjustments accordingly;
* Evaluates the result in terms of the negotiated plan and the client's evaluation of the. result.

Student Learning Experience 1

Purpose: Expose students to the floor systems in residential construction. Students will view handouts, read textbook to be able to ill various parts as theory is explained.

Estimated Time: 1.5 Contact hours

Standards:
Elc, E3a, E3e, Mla,Alc, A5a,

CABO 502-1, 502-1.1, 502-4.1

Key Concepts Addressed:
a. Glossary of terms
b. Exposure to different framing materials
c. Exposure to different fasteners
d. Walk students thru the building of a floor system
e. Introduce Rhode Island state building codes

Student Tasks:
a. Take notes
b. Interact in discussion
c. Ask appropriate questions
d. Interrupt information

Explanation of how learning tasks require higher-level thinking: Students must mentally compile handouts, readings in the textbook, and theory to develop the ability to restate information (E 1 c), ask relevant questions (E3b), take notes (E3c) and solve math problems (MIa) related to floor systems.

Teacher Responsibilities:
a. Involve class in discussion
b. Introduce terms
c. Introduce various framing materials
d. Introduce various fasteners
e. Help students appreciate the need for building codes

Materials & Equipment:
a. Handouts
b. Textbooks
c. Calculators
d. Paper & pencils

Resources:
a. Carpentry textbook
b. Graphic design book
c. CABO code book

INFORMATION SHEET

B 1

OBJECTIVE 1

FLOORS AND SILLS

Match terms associated with frame floors and sills to their correct definitions.

anchor bolt - bolt embedded in foundation; used to secure sill to foundation

Beam or girder - any large horizontal piece of timber, precast concrete, metal or other material used to support concentrated loads at particular points along its length

Bridging - wood or metal pieces fitted in pairs from bottom of one floor joist to top of adjacent joists, and crossed to distribute floor load; solid stock of same size material as joists may be used

Crown - high side of curve on edge of framing lumber

Foundation - supporting portion of a structure below the first Floor construction.' including the footings

Joist - one of a series of parallel framing members used to support floor and ceiling loads and supported, in turn, by beams or girders

Joist hanger - metal stirrup secured to face of structural member to support and align ends of joist flush with member

Joist header - framing member into which common joists are fitted forming the box sill; also used to support free ends of joist when framing openings in floor

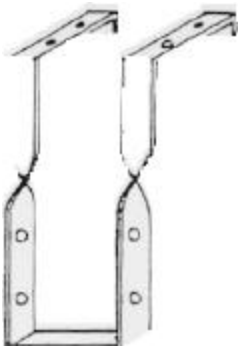
Sill - lowest member of structure's frame; rests horizontally on foundation and supports floor joists

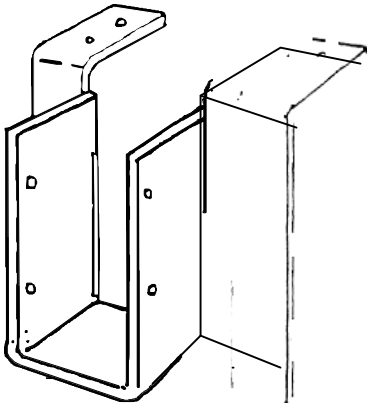
Sill sealer - resilient, waterproof material used under sill as a seal against air, dirt, and insects

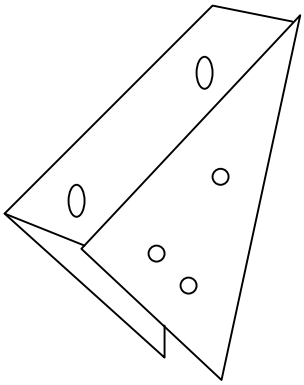
Span - distance between structural supports such as walls. columns, piers, beams, or girders

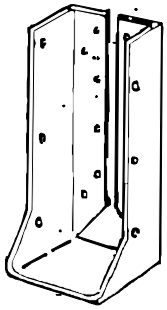
subfloor - boards or panels laid directly on floor joists and over which underlayment or finish floor is laid

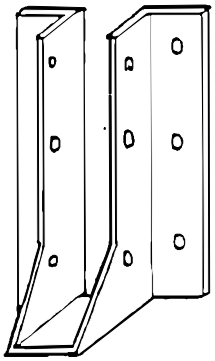
Types of Joist Hangers

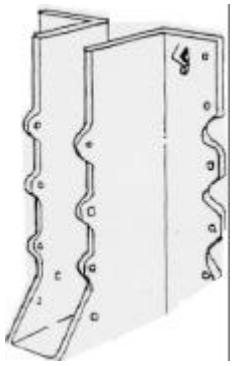


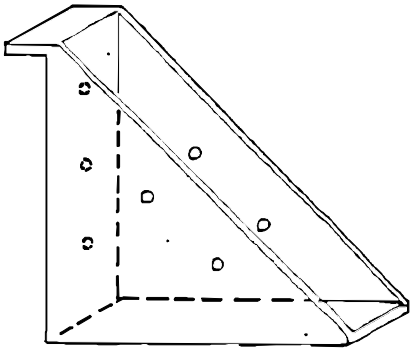


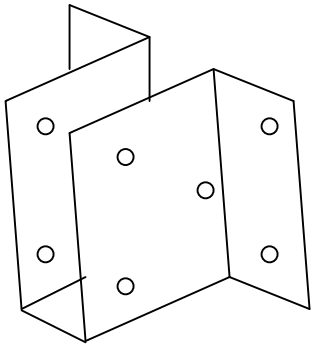












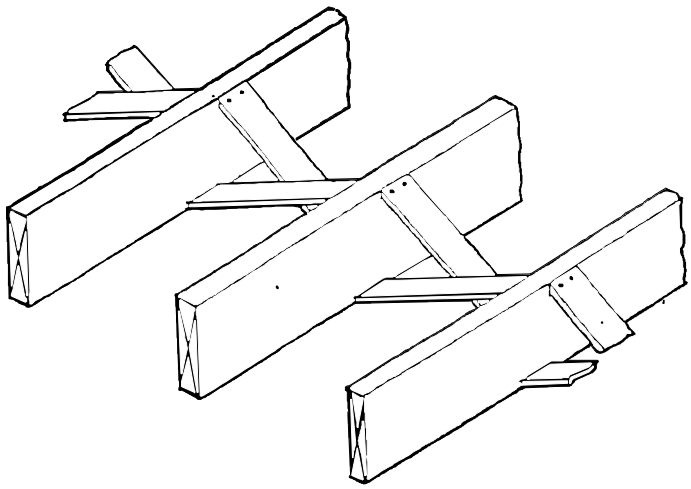
NOTE: these are only a sample of the many types available.

Transparency master residential carpentry CIMC B1 29

OBJECTIVE 6

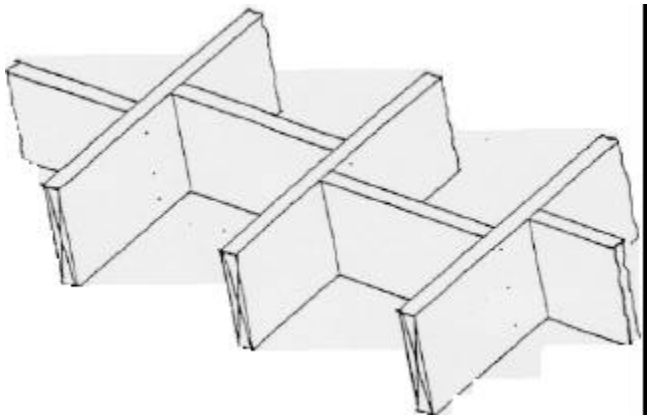
Wood "X" bridging (common type)

FIGURE 11



Solid wood

FIGURE 12



Steel

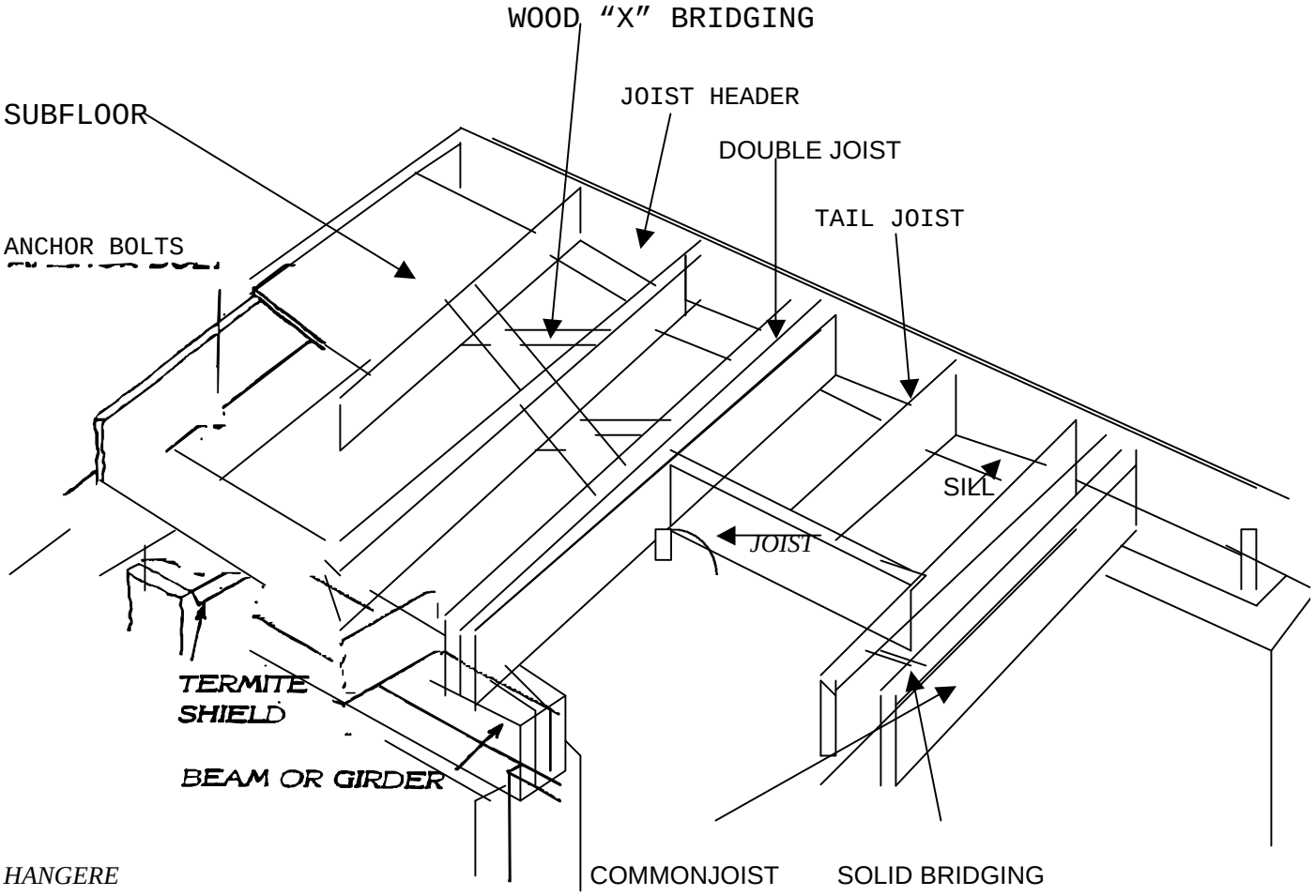
FIGURE 13

INFORMA1l0N SHEET – Residential Carpentry

ClMC - B I - 1

Termite shield-sheet metal on foundation wall under sill to prevent passage of termites into structure

OBJECTIVE 2 ID floor and sill framing and support members



OBJECTIVE 3

Name methods used to fasten sills to the foundation.

NOTE: Locate anchor bolts so that they will not be set under floor joist.

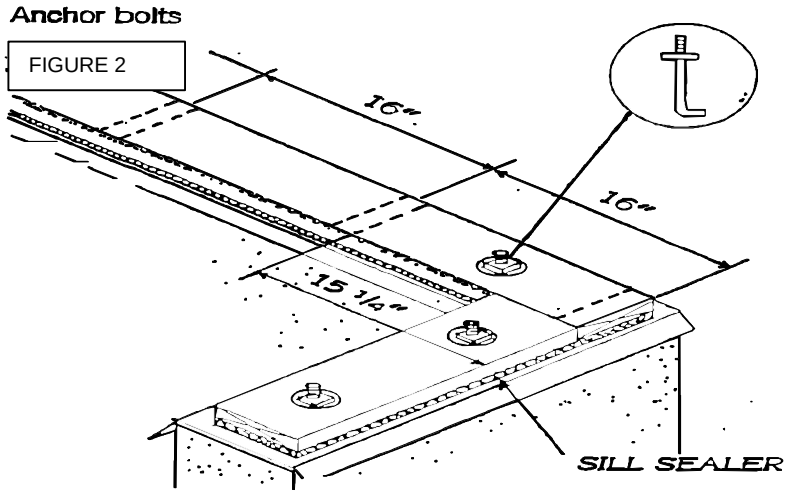
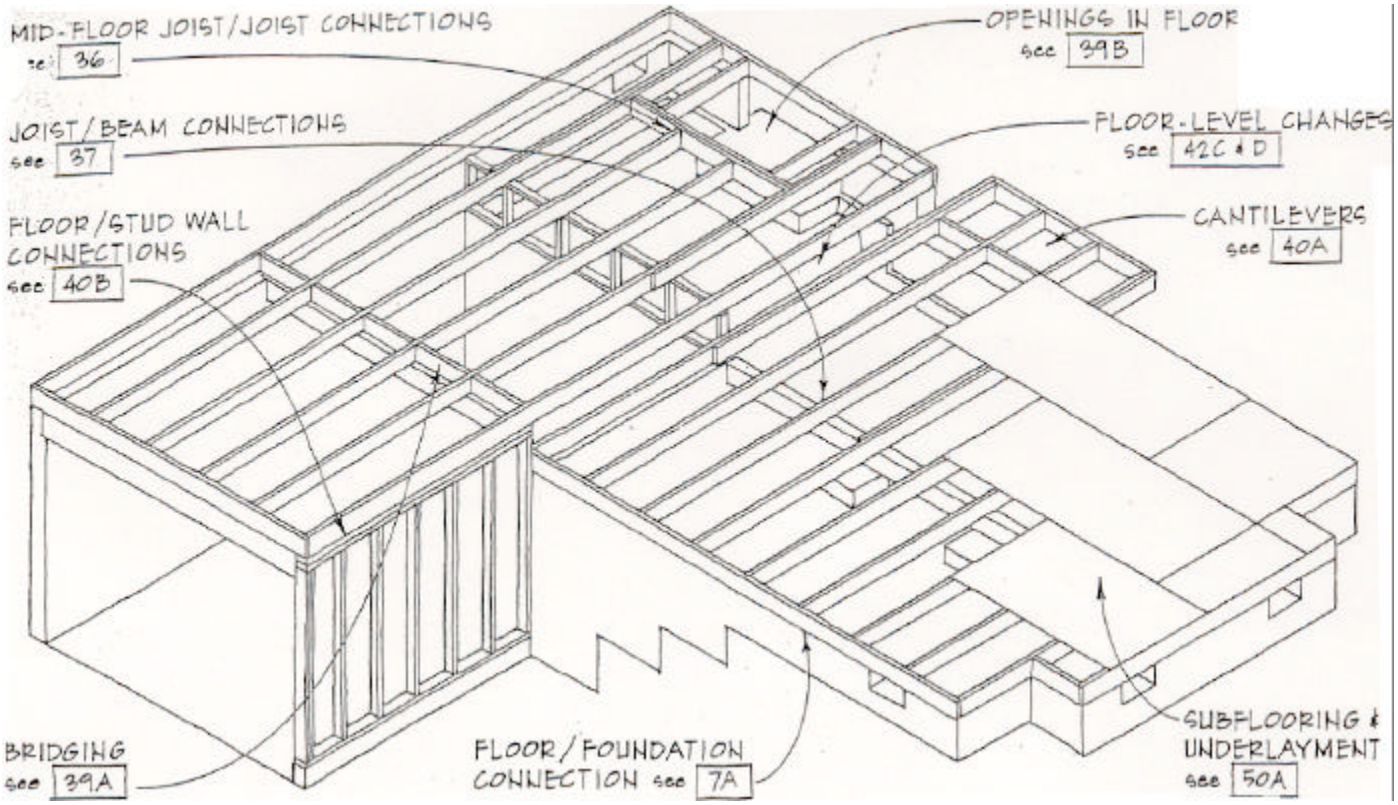


FIGURE 2

INFORMATION SHEET – Residential Carpentry
CIMC - B I - 12

Student Learning Experience 1 Appendix



A joist system is the most common floor structure in wood-frame buildings. The system is flexible and relatively inexpensive, and the materials are universally available. Species vary considerably from region to region, but sizes are uniform. The most common sizes for floors are 2x8, 2x1 0, and 2x12. Selection of floor-joist size depends on span; on spacing required for sub flooring, flooring and ceiling finishes (usually 12 in., 16 in., or 24 in.); and on depth required for insu1ation (usually over a crawl space) and/or utilities (over basements and in upper floors).

The table at right compares spans at common on-center spacing for three typical species and grades of framing lumber at four different sizes of joist (2x6, 2x8, 2x10 and 2x12). For information on plywood I-joists see 44 and 45; for information on wood trusses, see 46A. ONE AND TWO FAMILY DWELLING CODE

This table assumes a 40-psf live load, a 10-psf dead load and a deflection of L/360. This table is for estimation purposes only.

Joist-span comparison

Joist size, species and grade	Joist span (ft.) 12 in. o.c.	16 in. o.c.	24 in. o.c.
2x6 hem-fir #1	10.5	9.5	8.3
2x6 south. yellow pine #1	10.9	9.9	8.7
2x6 Douglas-fir #1	11.2	10.2	8.8
2x8 hem-fir #1	13.8	12.5	10.0
2x8 south. yellow pine	14.4	13.1	11.4
2x8 Douglas-fir #1	14.7	13.3	11.7
2x10 hem-fir #1	17.7	16.0	14.0
2x10 south. yellow pine #1	18.4	16.7	14.7
2x10 Douglas-fir #1	18.7	17.0	14.9
2x12 hem-fir #1	21.5	19.5	17.0
2x12 south. yellow pine #1	22.3	20.3	17.7
2 x 12 Douglas fir #1	22.8	20.8	18.1

TABLE 502.3.1a-continued

HOW TO USE TABLES: Enter table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

For SI: 1inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot =

JOIST SIZES AND SPACING		MODULUS OF ELASTICITY, "E," IN 1,000,000 PSI								
(Inches)	(Inches)	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
2 x 6	12.0	10-3 1,040	10-6 1,090	10-9 1,140	10-11 1,190	11-1 1,230	11-4 1,280	11-7 1,410	11-11 1,490	12-3 1,490
	13.7	9-10 1,090	10-0 1,140	10-3 1,190	10-6 1,240	10-8 1,290	10-10 1,340	11-1 1,380	11-5 1,470	11-9 1,560
	16.0	9-4 1,150	9-6 1,280	9-9 1,250	9-11 1,310	10-2 1,290	10-4 1,410	10-6 1,460	10-10 1,460	11-2 1,640
	19.2	8-9 1,220	9-0 1,280	9-2 1,330	9-4 1,390	9-6 1,440	9-8 1,500	9-10 1,550	10-2 1,550	10-6 1,750
	24.0	8-2 1,310	8-4 1,380	8-6 1,440	8-8 1,500	8-10 1,550	9-0 1,610	9-2 1,670	9-6 1,780	9-9 1,880
	32.0	7-5 1,450	7-7 1,520	7-9 1,590	7-11 1,660	8-0 1,690	8-2 1,760	8-4 1,840	8-7 1,950	8-10 2,060
2 x 8	12.0	13-6 1,040	13-10 1,090	14-2 1,140	14-5 1,190	14-8 1,230	15-0 1,280	15-3 1,280	15-9 1,410	16-2 1,490
	13.7	12-11 1,090	13-3 1,140	13-6 1,190	13-10 1,240	14-1 1,290	14-4 1,340	14-7 1,380	15-0 1,470	15-6 1,560
	16.0	12-3 1,150	12-7 1,200	12-10 1,250	13-1 1,310	13-4 1,360	13-7 1,410	13-10 1,460	14-3 1,550	14-8 1,640
	19.2	11-7 1,220	11-10 1,280	12-1 1,330	12-4 1,390	12-7 1,440	12-10 1,500	13-0 1,550	13-5 1,650	13-10 1,750
	24.0	10-9 1,310	11-0 1,380	11-3 1,440	11-5 1,500	11-8 1,550	11-11 1,610	12-1 1,670	12-6 1,780	12-10 1,880
	32.0	9-9 1,520	10-0 1,520	10-2 1,570	10-5 1,650	10-7 1,700	10-10 1,790	11-0 1,950	11-4 1,950	20-8 1,490
2 x 10	12.0	17-3 1,450	17-8 1,090	18-0 1,140	18-5 1,190	18-9 1,230	19-1 1,280	19-5 1,320	20-1 1,410	20-8 1,490
	13.7	16-6 1,090	16-11 1,140	17-3 1,190	17-11 1,290	17-11 1,290	18-3 1,340	18-7 1,380	19-2 1,470	19-9 1,560
	16.0	15-8 1,150	16-0 1,200	16-5 1,250	16-9 1,310	17-0 1,360	17-4 1,410	17-8 1,460	18-3 1,550	18-9 1,640
	19.2	14-9 1,220	15-1 1,280	15-5 1,330	15-9 1,390	16-0 1,440	16-4 1,550	16-7 1,550	17-2 1,650	17-8 1,750
	24.0	13-8 1,310	14-0 1,380	14-4 1,440	14-7 1,500	14-11 1,550	15-2 1,610	15-5 1,670	15-11 1,780	16-5 1,880
	32.0	12-5 1,440	19-9 1,520	13-0 1,580	13-3 1,640	13-6 1,700	13-9 1,770	14-0 1,830	14-6 1,970	14-11 2,080
2 x 12	12.0	21-0 1,040	21-6 1,090	21-11 1,140	22-5 1,190	22-10 1,230	23-3 180	23-7 1,320	24-5 1,410	25-1 1,490
	13.7	20-1 1,090	20-6 1,140	21-0 1,140	21-5 1,240	21-10 1,290	22-3 1,340	22-7 1,380	23-4 1,470	24-0 1,560
	16.0	19-1 1,150	19-6 1,200	19-11 1,250	20-4 1,310	20-9 1,360	21-1 1,460	21-6 1,460	22-2 1,550	22-10 1,640
	19-2	17-11 1,220	18-4 1,280	18-9 1,330	19-2 1,390	19-6 1,440	19-10 1,500	20-2 1,550	20-10 1,650	21-6 1,750
	24.0	16-8 1,310	17-0 1,380	17-5 1,440	17-9 1,500	18-1 1,550	18-5 1,610	18-9 1,670	19-4 1,780	19-11 1,880
	32.0	15-2 1,450	15-6 1,520	15-10 1,580	16-2 1,650	16-5 1,700	16-9 1,770	17-0 1,830	17-7 1,950	18-1 2,070

0.0479 kN/m2.
Note: The extreme fiber stress in bending “Fb,” in pounds per square inch is shown below each span

TABLE 502.3 1a
ALLOWABLE SPANS FOR FLOOR JOIST
40 Lbs. Per Sq. Ft. Live Load
(All rooms except those used for sleeping areas and attic floors.)

Strength- Live load of 40 lbs. Per sq. ft. plus dead load of 10 lbs. Per sq. ft. determines the fiber stress value shown.

DESIGN CRITERIA:
Deflection- For 40 lbs. Per sq. ft. live load.
Limited to span in inches divided by 360.

JOIST SIZE AND SPACING		MODULUS OF ELASTICITY, "E," IN 1,000,000 PSI									
(Inches)	(Inches)	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2 x 6	12.0	6-9 450	7-3 520	7-9 590	8-2 660	8-6 720	8-10 830	9-2 830	9-6 890	9-9 940	10-0 990
	13.7	6-6 470	7-0 580	7-5 620	7-9 690	8-2 750	8-6 810	8-9 870	9-1 930	9-40 980	9-7 1,040
	16.0	6-2 500	6-7 580	7-0 650	7-5 720	7-9 790	8-0 860	8-4 920	8-7 980	8-10 1,040	9-1 1,090
	19.2	5-9 530	6-3 610	6-7 690	7-0 770	7-3 840	7-7 910	7-10 970	8-1 1,040	8-4 1,100	8-7 1,160
	24.0	5-4 570	5-9 660	6-2 750	6-6 830	6-9 900	7-0 98	7-3 1,050	7-6 1,120	7-9 1,190	7-11 1,250
	32.0					6-2 1,010	6-5 1,090	6-7 1,150	6-10 1,230	7-0 1,300	7-3 1,390
2 x 8	12.0	8-11 450	9-7 520	10-2 590	10-9* 660	11-3 720	11-8 780	12-1 830	12-6 890	12-10 940	13-2 990
	13.7	8-6 470	9-2 550	9-9 620	10-3 690	10-9 750	11-2 810	11-7 870	11-11 930	12-3 980	12-7 1,040
	16.0	8-1 500	8-9 580	9-3 650	9-9 720	10-2 790	10-7 850	11-0 920	11-4 980	11-8 1,040	12-0 1,090
	19.2	7-7 530	8-2 610	8-9 690	9-2 770	9-7 840	10-0 910	10-4 970	10-8 1040	11-0 1,1000	11-3 1,160
	24.0	7-1 570	7-7 660	8-1 750	8-6 830	8-11 900	9-3 980	9-7 1,050	9-11 1,120	10-2 1,190	10-6 1,250
	32.0					8-1 990	8-5 1,080	8-9 1,170	9-0 1,230	9-3 1,300	9-6 1,370
2 x 10	12.0	11-4 450	12-3 520	13-0 590	13-8 660	14-4 720	14-11 780	15-5 830	15-11 890	16-5 940	16-10 990
	13.7	10-10 470	11-8 550	12-5 620	13-1 690	13-8 750	14-3 810	14-9 870	15-3 930	15-8 980	16-1 1,040
	16.0	10-4 500	11-1 580	11-10 650	12-5 720	13-0 790	13-6 850	14-0 920	14-6 980	14-11 1,040	15-3 1,090
	19.2	9-9 530	10-6 610	11-1 690	11-8 770	12-3 840	12-9 910	13-2 970	13-7 1,040	14-0 1,100	14-5 1,160
	24.0	9-0 570	9-9 660	10-4 750	10-10 830	11--4 900	11-10 980	12-3 1,050	12-8 1,120	13-0 1,190	13-4 1,250
	32.0					10-4 1,000	10-9 1,080	11-1 1,150	11-6 1,240	11-10 1,310	12-2 1,380
2 x 12	12.0	13-10 450	14-11 520	15-10 590	16-8 660	17-5 720	18-1 780	18-9 830	19-4 890	19-11 940	20-6 990
	13.7	13-3 470	14-3 550	15-2 620	15-11 690	16-8 750	17-4 810	17-11 870	18-6 930	19-1 980	19-7 1,040
	16.0	12-7 500	13-6 580	14-4 650	15-2 720	15-10 790	16-5 860	17-0 920	16-7 1,040	17-0 1,100	17-6 1,160
	19.2	11-10 530	12-9 610	13-6 690	14-3 770	14-11 840	15-6 910	16-0 970	16-7 1,040	17-0 1,100	17-6 1,160
	24.0	11-10 570	11-10 660	12-7 750	13-3 830	13-10 900	14-4 980	14-11 1,050	15-4 1,120	15-10 1,190	16-3 1,250

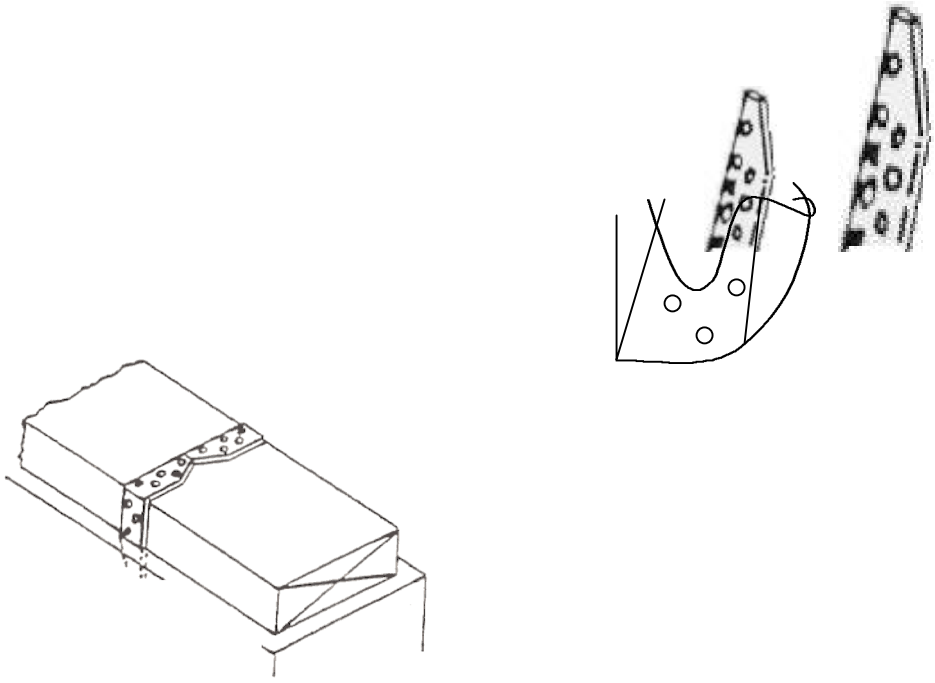
	32.0					12-7 1,000	13-1 1,080	13-6 1,150	13-11 1,220	14-4 1,300	14-9 1,380

For SI: 1inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m2.

Note : The extreme fiber stress in bending “Fb,” in pounds per square inch is shown below each span.

Meta! Plates or Straps

FIGURE 3

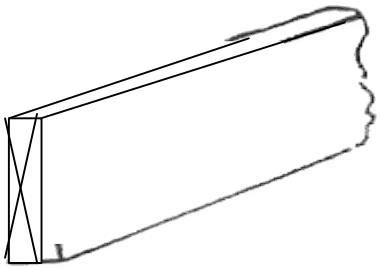


OBJECTIVE 4 Select from a list types of beams / girders.
Solid lumber
Built-up lumber
Steel I-beam
Pre-cast concrete
Solid timber

NOTE: A load bearing wall may take the place of a beam or girder.

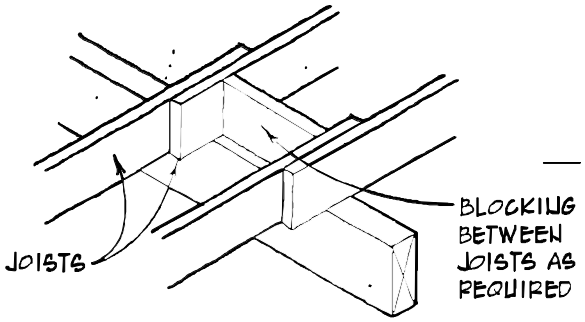
OBJECTIVE 5 List types of floor joists.

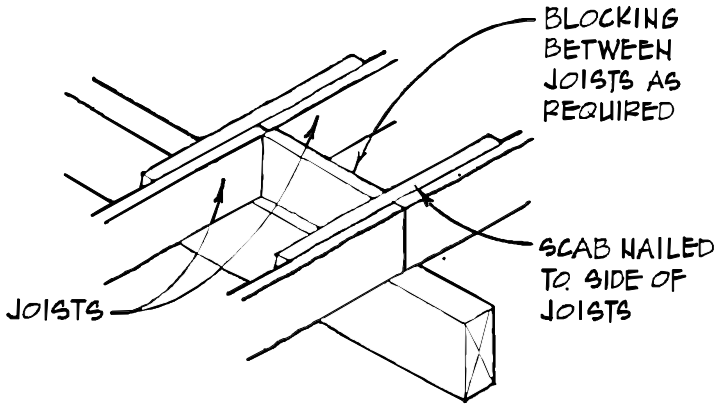
Wood FIGURE 4



Solid lumber

Student Learning Experience 2 Appendix





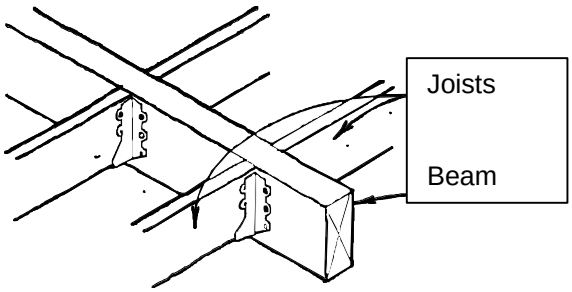
Lapped Joist: This common joist requires shifting the sub floor layout 11/2 in. on opposite sides of the beam to allow the sub floor to bear on the joist.

Spliced Joist Butt: joists to maintain same spacing for nailing sub floor on each side of the beam.

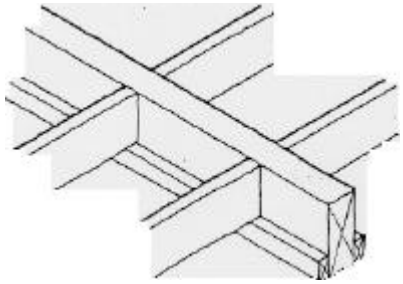
Note: Scab must be long enough to qualify splice as a single joist to that adequate bearing on beam is achieved. Verify with local codes.

Note: Lapped joist and spliced joists are commonly used over a crawl space or other location where head clearance below the beam is not required.

A: JOIST / WOOD BEAM CONNECTIONS



Joist hangers
Align joists on each side of beam to maintain same spacing for subfloor nailing.

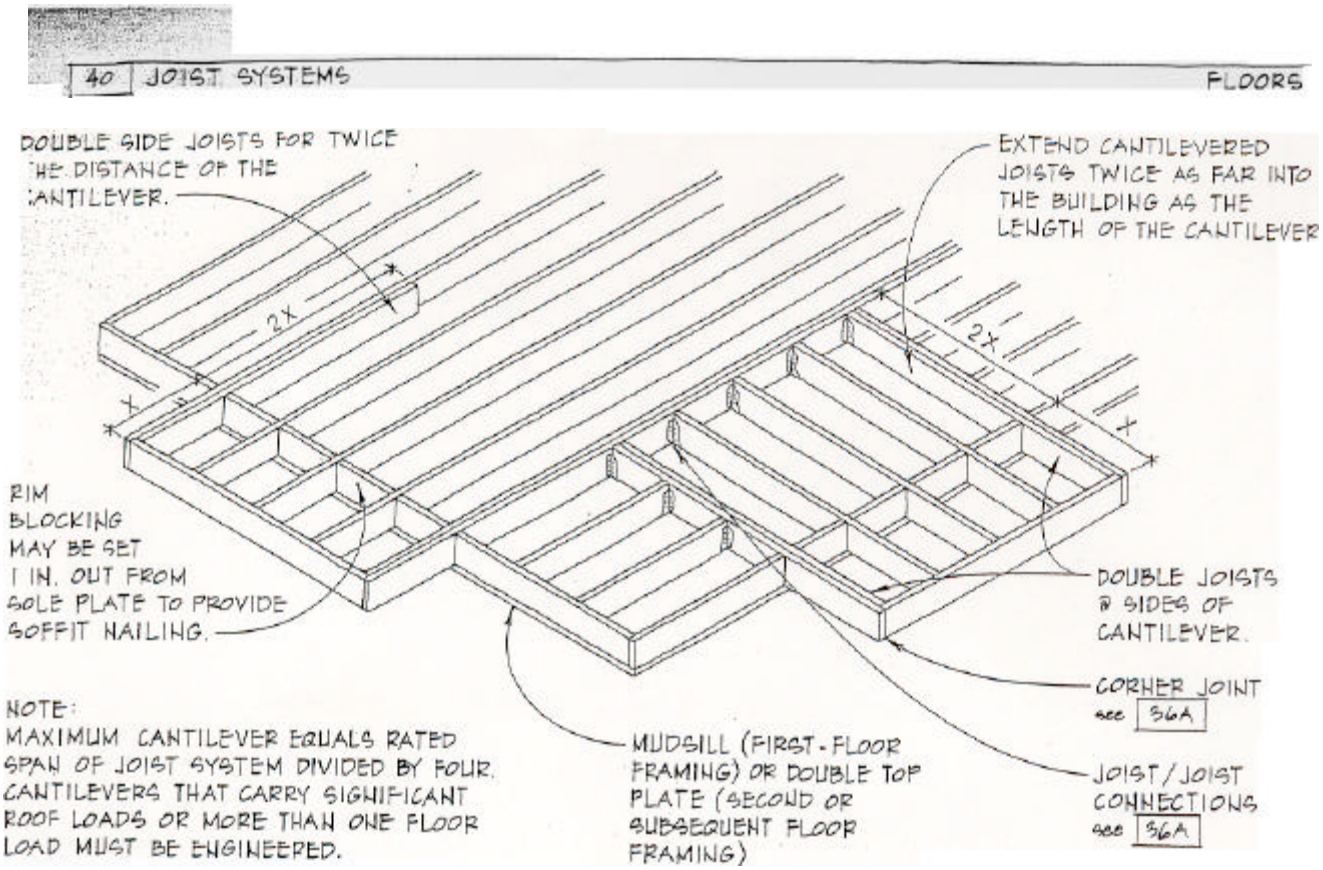


Joist on ledger
A 2 x 2 or 2 x 4 ledger nailed to the beam supports the joists. Toenail the joists to the beam or block between joists. Notch joists to 1/3 of depth if required to fit over ledger.

Note:
Joist hangers and joists on ledge are use where maximum head clearance is required below the floor. They work best if the joists and beam are of similar species and moisture content so that one does not shrink more than the other.

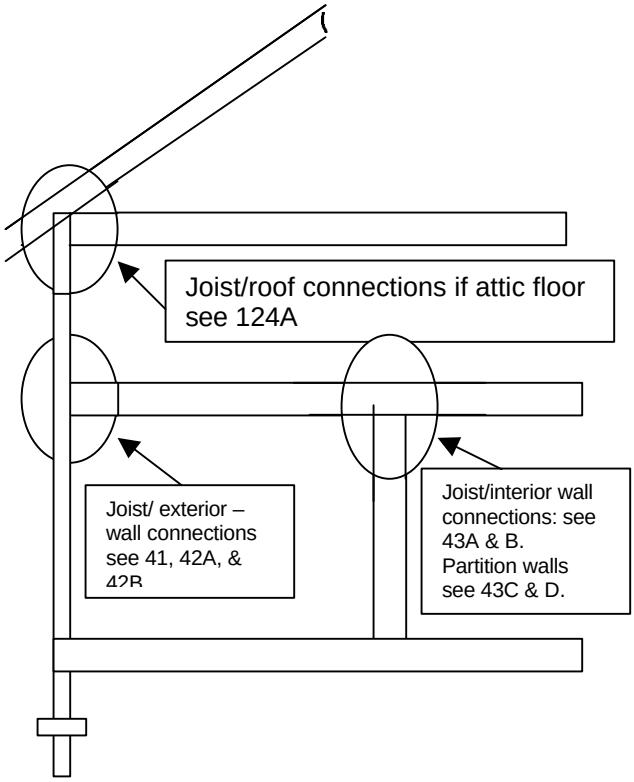
B: Joist / Wood Beam Connections

Beam flush with joists



A: floor cantilevers

II and I to joist system



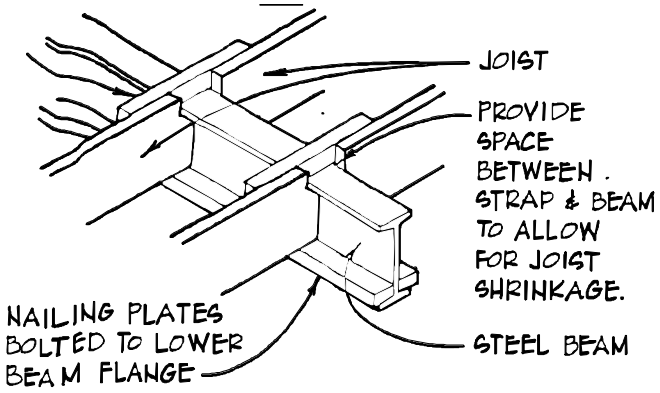
Joist – Floor system connections to exterior walls are straightforward. Wall framing may be one of two types.

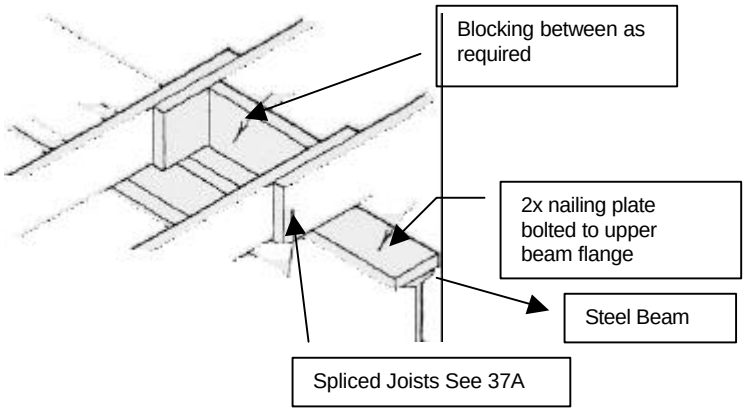
Platform framing--Platform framing, the most common system in use today, takes advantage of standard materials and framing methods. The ground floor and all upper floors can be constructed using the same system.

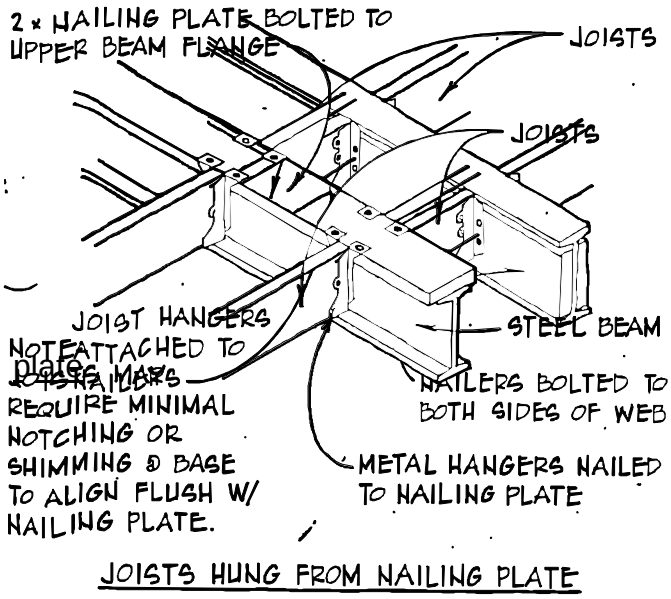
Balloon framing—Balloon framing is rarely used because it is harder to erect and requires very long studs. It may be the system of choice, however, if the floor structure must work with the walls to resist lateral roof loads or if extra care is required to make the insulation and vapor barrier continues from floor to floor.

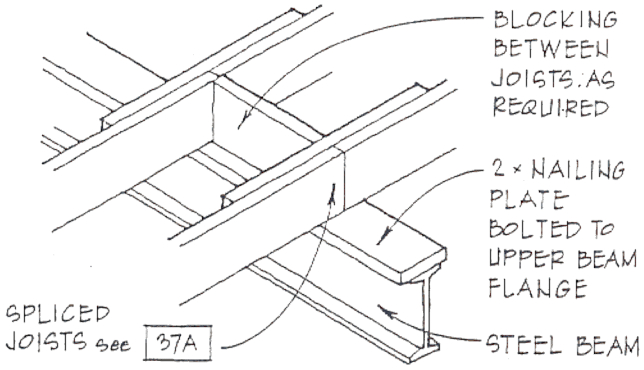
Joist-floor system connections to interior walls dependant on whether the walls are load-bearing walls or partition walls. The other factor to consider is whether edge ailing is required for the ceiling.

B: Joist / Stud-wall Connections

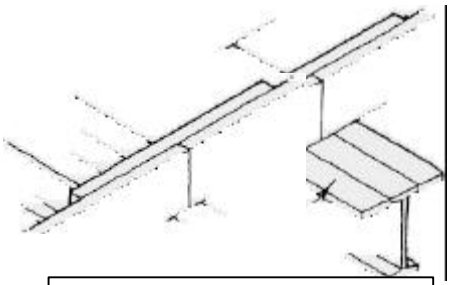








Note: Use only in conditions without uplift forces and where scabs will now where scabs will not interfere with ceiling.



1 x boards scabbed to underside of joist. Keep joist aligned and prevent lateral movement of steel beam.

A JOIST/STEEL BEAM CONNECTIONS
BEAM FLUSH W/ JOISTS

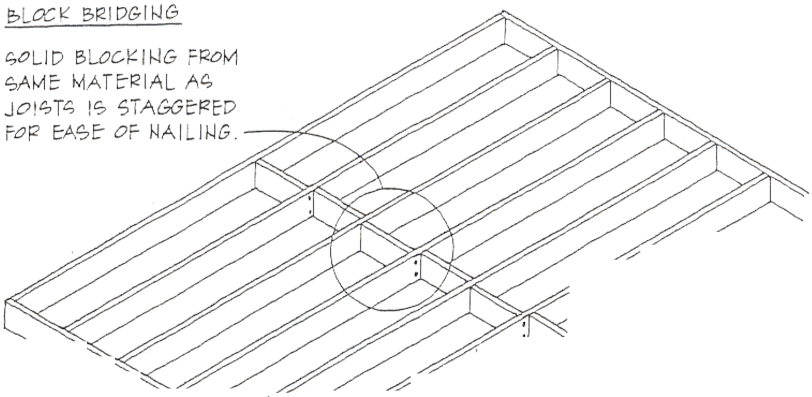
B: Joist steel Beam Connections

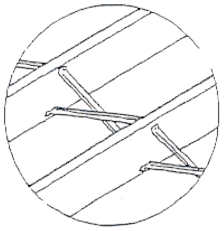
Beam below joists

FLOORS JOIST SYSTEMS 39

BLOCK BRIDGING

SOLID BLOCKING FROM SAME MATERIAL AS JOISTS IS STAGGERED FOR EASE OF NAILING.

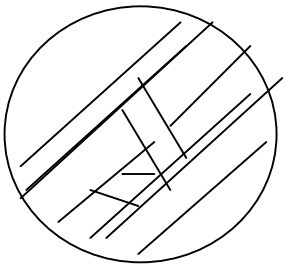




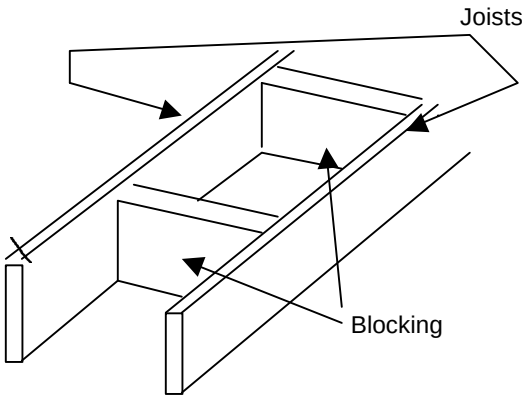
Metal Bridging: Metal pieces should not touch each other.

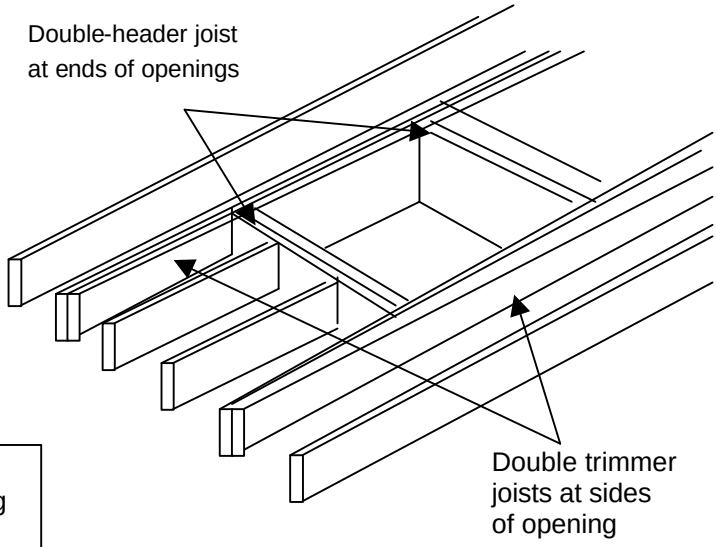
Note: For deep joist with long spans (over 8 feet), local codes may require bridging to prevent rotation and to distribute the load.

Cross Bridging: 5/4 x 3 or 5/4 x 4 or 2 x 2 or 1 x 4 boards are nailed in a cross pattern between joist. Pieces should not touch each other



A BRIDGING





Small Opening: Opening that fits between two joists for laundry chutes or heating ducts are simply made by nailing blocking between the joists.

Large Openings: In an opening that is wider than the joist spacing, such as for stairways and chimneys, the floor structure around the opening must be strengthened. For openings up to three joist spaces wide, doubling the joists as the sides and ends of the opening may suffice. Eider openings should be engineered.

B OPENINGS IN JOIST-FLOOR SYSTEM

Learning Experience 3 Student

Purpose: (Application) Students will incorporate learning experiences one and two to design and build a floor system. They will estimate materials and time needed to build a floor system and begin building it.

Estimated Time: App. 15 contact hours

Standards:

M6a, M61, M7b" Alc, A4b, A5a, A5c,
CABO 301-3,301-4,502-1,502-1.1,502-1.2,502-3, 502-4, 502-4.1, 502-5.1, 502-8

Key Concepts Addressed:

a. All concepts from learning experience one and two
b. Students must put a value on the floor system; estimate proper size of material, cost, and the time in man hours to build a IO'x12' floor system

Student Tasks:

a. Student takes notes b. Incorporate data c. Interpret data
d. Begin to layout stock
e. Cut and assemble floor system

Explanation of how learning tasks require higher-level thinking: Students must incorporate what they have learned and follow a sequence of events. Students must define roles and share responsibilities (A5a). The students must develop a print, carry out numerical calculation (M6a), use math accurately with their print and span charts (M7b), the students will develop a schedule and organize a sequence of events (AI c). Students develop and maintain a work schedule (A4b) Students evaluate the results (A5c) that meets code

Teacher Responsibilities: Instructor guides students in the safe application of these learning experiences to produce the lO'x12' floor system

Materials & Equipment:

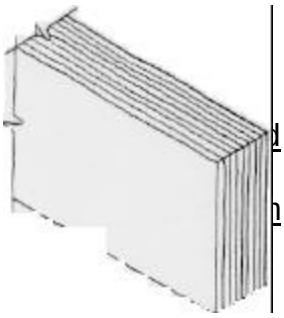
a. Lumber
b. Tools
c. Print

Student Learning Experience 3 Appendix

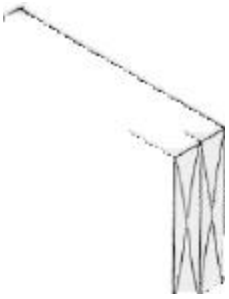
[

Student Learning Experience 3 Appendix

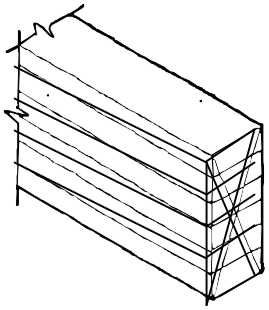
32 BEAMS FLOORS



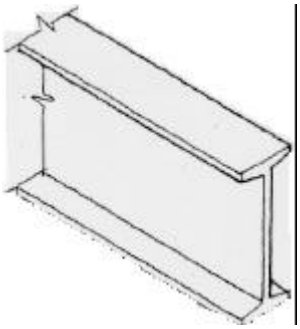
Laminated Veneer (LVL) Beam: laminated sections are actual widths are multiples to match thickness of 2x4 from 5 ½ in. to 18 in.



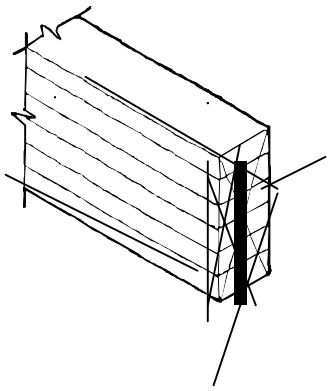
Built-up Beam: Dimension lumber is nailed together to make a beam (four pieces max.). Widths are multiples of 1 ½in. dimension lumber.



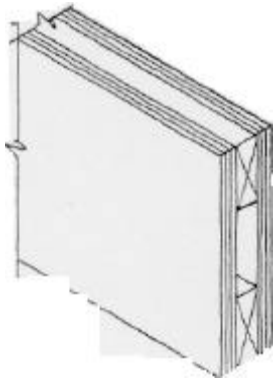
Laminated Lumber Beam: Horizontal factory – Glued laminations make a know-free and very stable beam. Actual widths are 3 1/8 in. wide 5 1/8 in, 7 1/8 in., etc. Heights are in multiples of 11 ½in.



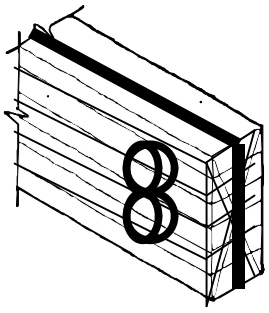
Steel Beam: The strongest of the beams for a given size, steel beams are commonly available in sizes from 4 in. high to 12 in. wide and 36 in. high they may be predrilled for bolting wood plate to top flange or to weld.



Cut Timber: Timber beams are available in a variety of species and grades. Douglas fir is the strongest. Actual widths are 3 ½in. and 5 ½ in. Actual heights are 5 ½in., 7 ½in., etc., to 13 ½in.



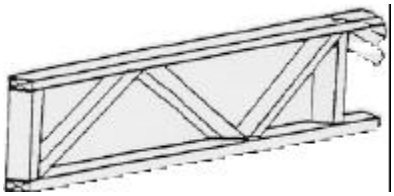
Box Beam: 2x4 lumber is sandwiched between two plywood skins. Plywood is both nailed and glued to 2x4s and at all edges. Plywood joints must be offset.



Flitch Beam: A steel plate sandwiched between two pieces of lumber adds strength without substantially increasing beam size. The lumber prevents buckling of the steel and provides a nailing surface. Widths are 3 in. to 3 ½in. Heights follow dimension lumber.

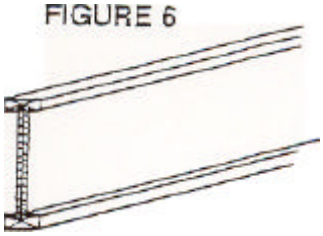
Note: Beams and joints must be designed as a system. Connections between joists and beams are similar for all wood-beam types see 37. For connections to steel beams see 38.

FIGURE 5



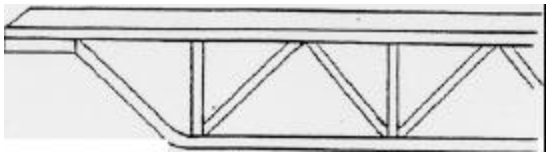
Truss Type

FIGURE 6



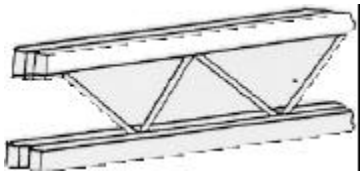
Plywood Web Type

FIGURE 7

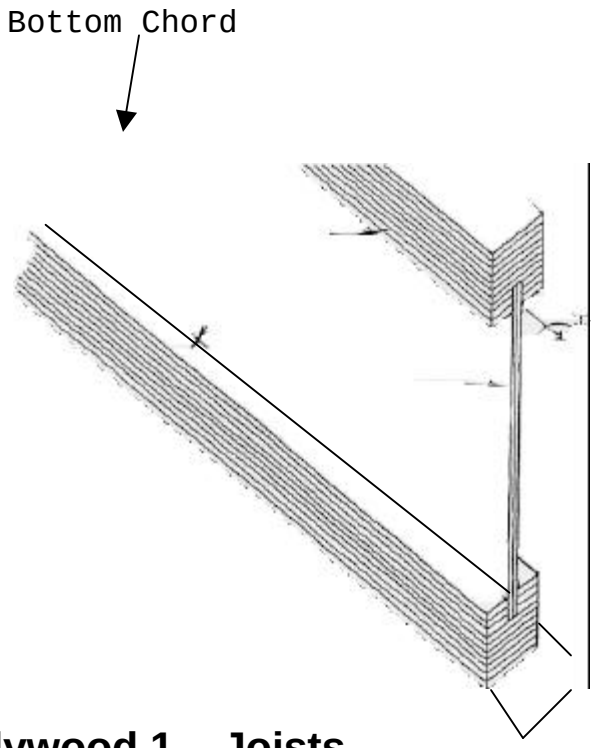


Open Web Steel
(Steel Bar Joist)

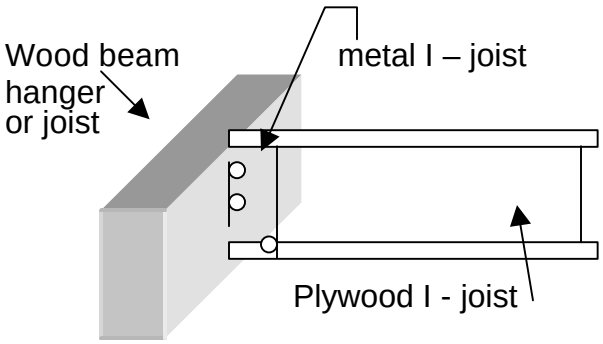
FIGURE 10

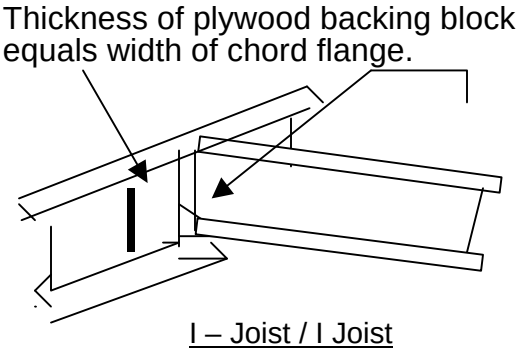


Wood and steel open web



Plywood 1 – Joists___





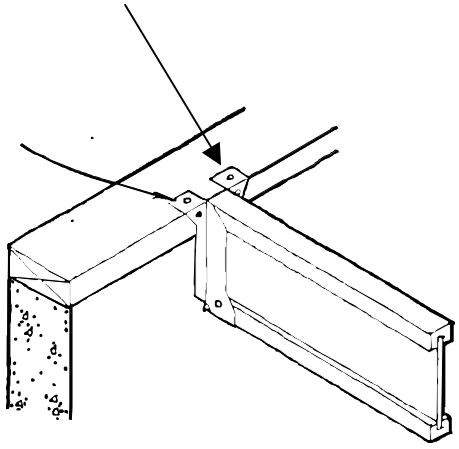
I – Joist / I Joist

B: Plywood I-Joist Connections:

Plywood I joists are designed to act as a small truss and are manufactured with laminated webs and laminated or solid top and bottom chords. I-joists are straighter and more precisely sized than dimension lumber and therefore make a flatter and quieter floor. Their spanning capacity for a given depth is only slightly greater than lumber joists (up to 20 in. deep and 60 ft. long), they may be the floor-framing system of choice when long spans are required (16 in. I-joists can span 27 ft. with residential floor loads). Carpenters comment that plywood I-joists are practical for long spans and simple plans, but difficult for complicated buildings.

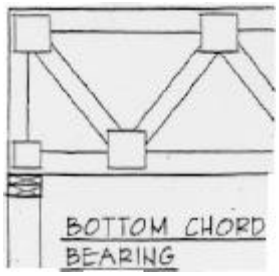
I-joists can be attached to each other with metal straps and hangers and can be cut on site. I-joists are about. 50% lighter than lumber joists and do not have as much strength in compression under concentrated loads. They must therefore be stiffened under bearing walls and in other conditions as required by manufacturers' specifications and local codes.

Special metal hangers for such conditions as top – mounted joists and skewed joists are available for attaching I – joists.



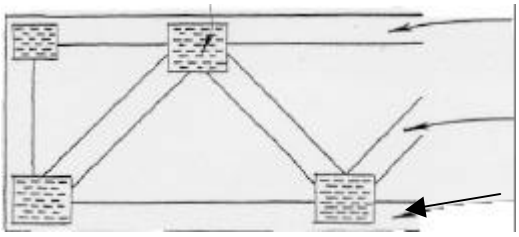
Special Conditions

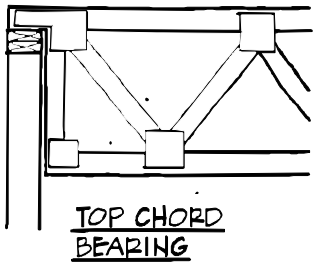
Four-by-two wood floor trusses are made up of small members {usually 2x4s} that are connected so that they act like a single large member. The parallel top and bottom chords and the webs are made of lumber held together at the intersections with toothed metal plates.



The open web allows for utilities to run through the floor without altering the truss. Round ducts from 5 In. to 16 in. in diameter can be accommodated, depending on the depth of the truss. Truss depths vary from 10 in. to 24 in., with spans up to about 30 ft. Like plywood I -joists. floor trusses are practical for long spans and simple plans, but difficult for complicated buildings.

METAL PL ATE





Floor trusses are custom manufactured for each job, and cannot be altered at this site. Bearing walls, floor openings and other departures from the simple span should always be engineered by the manufactures.

A WOOD FLOOR TRUSSES

Core Assessment

Estimated Time: 1.5 contact Hours

Student Tasks

The students have been walked through the basic floor system to the point of building their floor system. They have learned building codes related to floor systems" read blue prints" calculated time, materials, and spans. They are now able to reflect on the learning experience and critique their results.

Explanation of How Assessment Tasks Require Higher Level Thinking:

Part 1 As the proceeding process happens; the instructor is able to evaluate the outcome of not only the class but also the individual student by the dialogue that transpires. This open debate of the finished product gives insight to the learning process. It allows the instructor to see the students who interact and those who do not, and allows the instructor to draw those who do not interact into the discussion to gain insight to what they have and have not learned.

Part 2 The finished product is only part of the evidence of their learned knowledge.

Part 3 The application, the actual planning and building process.

Teacher's Responsibilities:

Engage students Give handouts
Demonstrate ideas
Encourage students
Draw Student into the lesson
Make success possible for students to educate

The responsibilities of the instructor are to take a student from his/her present knowledge level to the next.

Rubric

Cranston Area Career & Technical Center
Floor Systems

Name: _____ Teacher:_____

Criteria					Points
	1	2	3	4	
Student will ID parts of the floor system	Student is unable to ID parts of the floor system	Student is able to ID parts of the floor system but does not meet standards	Student is able to ID the parts of the floor system and meets standards	Student exceeds the standards by drawing and ID a floor system	_____
The student is able to use the span chart and choose the proper fasteners for the application	Students unable to use the span chart	The student is able to use the span chart but below standard	The student is able to use the span chart and appropriate fasteners to meet standard	The student is able to use the span chart and fasteners and table in a floor system print	_____
Student is able to choose the correct materials, layout, and assemble a floor system	Student is unable to perform any part of this project	Student is able to perform in this task but is below standard	Student is able to perform to standard	Student takes a leadership roll in the project and is able to complete	_____
The student is able to reflect on the experience and show interest and understanding	Student is not interested	Student is interested but is lacking the knowledge to evaluate	Student is actively interested and takes responsibility	Student is able to see mistakes and may-be a better way of completed	_____
				Total	_____

Date: _____ Title o f Work: _____

Teacher Comments

Cranston Area Career & Technical Center

Core Learning Experience Summary Chart

Name: _____ Teacher: _____

Date : _____ Title of Work: _____

	Criteria	
	1	2
Student Learning Experience 1	Student Task: take notes, handouts and interact in theory. They will label floor system parts. Students will design a floor system on paper with identified parts.	Instructional Methodologies: Engage the students helping them understand the importance of a properly built floor system. Give out handouts and theory at a rate that allows them time to receive and understand the information.
Student Learning Experience 2	Student Task: Students receive handouts (span charts, building code reference sheets, fastener sheets and textbook materials to begin estimating proper materials for a floor system of the instructors design.	Instructional Methodologies: The theory must involve the class in this lecture and show how the wrong choices can lead to problems Examples such as noisy floors, stressed floor members and inspectors rejection of the project. Other demonstrations such as using a 2" x 4" piece of stock supported at two ends. Apply force at a mid point and note the deflection with regards to the length.
Student Learning Experience 3	ask: Students must combine the and apply it to complete the floor tem they have designed.	Instructional Methodologies: The instructor's role at this point is to guide and support the student by asking questions that inspire the student to validate their project and progress.

Teacher Comments: